



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/796,824	03/09/2004	Wei Wang	AM-6535.D1	2457

7590 06/10/2005

Applied Materials, Inc.
Patent / Legal Dept., M/S 2061
P.O. Box 450A
Santa Clara, CA 95052

EXAMINER

MCDONALD, RODNEY GLENN

ART UNIT	PAPER NUMBER
----------	--------------

1753

DATE MAILED: 06/10/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/796,824

Applicant(s)

WANG, WEI

Examiner

Rodney G. McDonald

Art Unit

1753

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 March 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

22

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 4, 5 and 10 are rejected under 35 U.S.C. 102(a) as being anticipated by Fai Lai (U.S. Pat. 6,217,716).

Fai Lai teach a vault shaped sputtering target as seen in Fig. 10. Fai Lai teach a principal target in the form of a hollow cathode 132 for sputtering that has a sidewall and roof shaped like a vault. A magnetic means 129 surrounds the sidewall of the cathode. A rotating magnet 126 is positioned on the back side of the roof and is rotatable about the central axis. The magnet polarity of magnet 129 extends along the central axis. (Fig. 10; Column 8 lines 30-49) The cathode can sputter target material on substrates. (Column 1 line 30)

Claims 1, 4, 5, 6, 10 and 12 are rejected under 35 U.S.C. 102(a) as being anticipated by Lai et al. (U.S. Pat. 6,444,105).

Lai et al. teach in Fig. 3A a vault shaped hollow cathode for sputtering. Magnet means are present in the form of magnets 11 stacked in-between iron shims 12 arranged along the sidewalls of the cathode. Magnets 11 are oriented to generate magnetic flux in the axial (or Z) direction. Top pole piece 207 and bottom pole piece 205 are placed on the north and south sides of permanent magnet array 5, respectively, to direct and focus magnet field lines. A rotating magnet array 6 located at the back of the roof of the hollow cathode is provided. (Figure 3A; Column 5 lines 59-68; Column 6 lines 1-2) The hollow cathode can be utilized to sputter on a substrate 2. (Column 3 lines 22-24)

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-3, 8, 10 and 12-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lai (U.S. Pat. 6,217,716) or Lai et al. (U.S. Pat. 6,444,105) in view of Gopalraja et al. (EP 1119017).

Lai '716 is discussed above and all is as applies above. (See Lai '716 discussed above)

Lai et al. '105 is discussed above and all is as applies above. (See Lai et al. '105 discussed above)

The differences between Lai '716 or Lai et al. '105 and the present claims is that the magnetron comprising a first magnet assembly of a first magnetic polarity along the central axis and a second magnet assembly of a second magnetic polarity opposite the first magnet polarity and surrounding the first magnet assembly is not discussed, where the plurality of magnets arranged around an exterior of the sidewall have the second magnetic polarity is not discussed, a vacuum chamber is not discussed and a pedestal for supporting a substrate in the vacuum chamber is not discussed.

Gopalraja et al. teach in Fig. 13 a scanning magnetron on the roof of a target having a first magnet 240 with a first magnetic polarity along the central axis and a second magnet 238 surrounding the first magnet and having a second magnetic polarity. The magnet 222 surrounding the sidewall has the second magnetic polarity. (See Fig. 13; Column 19 lines 4-9, lines 26-32) The cathode can be in a sputter reactor 10 with a wafer clamped to a pedestal electrode 54. (Column 11 line 32, line 40-43)

The motivation for selecting the magnets to be a particular order is that it allows for achieving a desired erosion pattern. (Column 19 lines 20-22)

The motivation for utilizing a sputter reactor and pedestal is that it allows for sputtering on the wafer for via filling. (Column 1 lines 5-7)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Lai '716 or Lai et al. '105 by utilizing a first magnet assembly of a first magnetic polarity along the central axis and a second magnet assembly of a second magnetic polarity opposite the first magnet polarity and surrounding the first magnet assembly, arranging the plurality of magnets around an exterior of the sidewall having the second magnetic polarity, utilizing a vacuum chamber and utilizing a pedestal for supporting a substrate in the vacuum chamber as taught by Gopalraja et al. because it allows for achieving a desired erosion pattern and for sputtering on the wafer for via filling.

Claims 1 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lai (U.S. Pat. 6,217,716) or Lai et al. (U.S. Pat. 6,444,105) in view of Haag et al. (U.S. Pat. 6,337,001), Glocker et al. (U.S. Pat. 5,069,770) and Kumar (U.S. Pat. 5,178,743).

Lai '716 is discussed above and all is as applies above. (See Lai '716 discussed above)

Lai et al. '105 is discussed above and all is as applies above. (See Lai et al. '105 discussed above)

The differences between Lai '176 or Lai et al. '105 and the present claims is that utilizing a plate comprising the material and closing a throat of the vault opposite the roof is not discussed.

Haag et al. teach in Figure 8 annular plates with a partially closed throat. (See Figure 8) In Fig. 2 the plates 8a close a throat of a target. (See Fig. 2) Figure 5 shows the target can be annular. (See Figure 5; Column 5 line 2)

The motivation for utilizing a closed throat is that it increase plasma density within the hollow target. (Column 3 lines 2-3)

Glocker teach a sputtering process which employs a target which defines a hollow sputtering chamber having a relatively small orifice or slit through which particles, sputtered from the chamber-defining interior surfaces of the target, can exit the chamber and deposit on a workpiece or substrate disposed externally of the chamber and facing the orifice. (See Abstract)

A preferred enclosed target is in the form of a hollow cylinder with a circular hole in one end. The outside diameter of the cylinder is 7.4 cm, and the height is 4 cm. The inside diameter of the sputtering chamber is 4.6 cm and the height of such chamber is 2 cm. The hole has a diameter of about 1 cm. (Column 3 lines 1-6)

The motivation for utilizing a closed throat is that it confines the plasma. (Column 2 line 55)

Kumar teach a cathode 4 comprises a container element 30, top 32 and means 34 for connecting the top 32 to container element 30. This latter means is shown as a plurality of screws 34 driven through an equal number of holes through the top 32 into corresponding tapped holes in the container element 30. Of course other means for connecting top 32 to container element 30 may be employed. For example, top 32 and container element 30 may be provided with engaging threads or interlocking slots and notches. It is within the scope of the present invention to employ any conventional connecting means to connect top 32 to container element 30. (Column 5 lines 23-34)

The top 32, which needs to be only slightly large than the major opening of the container element 30, has a diameter in the actually constructed embodiment which is about equal to the outer cylindrical diameter of container element 30, that is, two and one-half inches. The top 32 is about one eighth inch thick, as is the bottom portion 38 of the container element 30. The top 32, like the container element 30, also has a central axial hole 39 extending therethrough within is about one half inch in diameter. The top 32 and the container element 30 were formed of copper by conventional techniques. (Column 5 lines 55-68; Column 6 lines 1-6)

The motivation utilizing an attached plate to close the throat is that it allows for confinement of plasma and easier of removal of the cathode 30 for replacement. (See Figure 3)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Gopalraja et al. by utilizing a closed throat of a sputtering target and closing the throat by an attachable plate as taught by the combination of Haag et al., Glocker et al. and Kumar because it allows for confining the plasma.

Claims 11 and 15-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over as applied to claims 1-3, 8, 10, 12-14 above, and further in view of Haag et al. (U.S. Pat. 6,337,001).

The difference not yet discussed is the use of anode between the target and the substrate.

Haag et al. suggest an anode 8a in Fig. 2 that is positioned between the target and the substrate. (i.e. see Fig. 9 for positional relationship of the target and the substrate). The anode is bias able to control particle energy. (See Fig. 2; Column 4 lines 16-27)

The motivation for utilizing an anode is that it allows for control of particles. (See Column 4 lines 16-27)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized an anode as taught by Haag et al. because it allows control of particles.

Claims 1 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lai (U.S. Pat. 6,217,716) or Lai et al. (U.S. Pat. 6,444,105) in view of Glocker et al. (U.S. Pat. 5,069,770).

The difference not yet discussed is where the magnetic means do not extend beyond a front sputtering surface of the roof.

Glocker et al. teach a magnetic means 20 not extending beyond a front face of the target. (Column 2 lines 42-45; Fig. 1)

The motivation for utilizing a magnetic means that does not extend beyond the front face surface of the target is that it allows for decreasing the number of high energy electrons escaping from the sputtering chamber during sputtering. (Column 1 lines 50-55)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized a magnetic means that does not extend

beyond the front surface of the target as taught by Glocker et al. because it allows for decreasing the number of high energy electrons escaping from the sputtering chamber during sputtering.

Response to Arguments

Applicant's arguments filed 3-22-05 have been fully considered but they are not persuasive.

The 35 U.S.C. 112 2nd paragraph rejections have been overcome. The terminal disclaimer overcomes the double patenting rejection.

RESPONSE TO ARGUMENTS:

In response to the argument that Lai et al. '716 or Lai '105 does not teach a magnetic means not extending above a back of the roof, it is argued that Lai et al. '716 or Lai '105 teach that the magnetic means does not extend above the back of the roof of the target. From the Figures the magnets are not above the roof but are rather adjacent to the roof. (See Lai '716 or Lai '105 discussed above)

In response to the argument that Gopalraja is not combinable with Lai' 105 or Lai '176 because the geometry of the Gopalraja is different than the geometry of Lai '105 or Lai '176, it is argued that the magnetic means taught by Gopalraja would be useable in the apparatus of Lai '105 or Lai '176 because it allows for controlling the erosion of a sputtering target. (See Lai '105, Lai '176 and Gopalraja discussed above)

In response to the argument that Gopalraja does not suggest the magnetic outer pole of the roof magnetic to be the same as the polarity of the single sidewall magnet, it is argued that Gopalraja does suggest that the magnetic outer pole being the same as

the polarity of the encircling magnet 222 and thus suggest that the magnetic outer pole of the roof magnet be the same as the polarity of the sidewall magnet. (See Gopalraja discussed above)

In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

In response to the argument that Haag, Glocker and Kumar do not suggest the closed throat feature, it is argued that in Haag, Glocker and Kumar there is suggested a means for producing the closed throat. The references therefore suggest the limitation of the closed throat. (See Haag, Glocker, and Kumar discussed above)

In response to the argument that Haag teaches an anode inside that target, it is argued that in Fig. 8 the anode can be alternatively placed outside the target as shown in dotted lines of Fig. 8 to thereby close the through o the target. The anode would be between the target and the substrate and could be biased to control particle flow. (See Haag discussed above)

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rodney G. McDonald whose telephone number is 571-272-1340. The examiner can normally be reached on M- Th with Every other Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Art Unit: 1753

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Rodney G. McDonald
Primary Examiner
Art Unit 1753

RM
June 7, 2005